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ELECTROACUPUNCTURE TREATMENT OF OBESITY WITH PSYCHOLOGICAL SYMPTOMS

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The aim was to study the effect of placebo EA, electroacupuncture (EA), and diet on obesity and accompanying psychological symptoms. One hundred and sixty-five volunteer women participated in the study. There were three groups: (i) Placebo EA, (ii) EA, and (iii) diet restriction group. EA was performed by using three ear and six body points. There was a 4.8% reduction in weight of patients with EA application, whereas patients with a diet restriction and placebo EA had a 2.5% and 2.7% weight reduction, respectively. There were significant decreases in phobia, anger, anxiety, obsession, paranoid symptoms, and depression in the EA groups compared to those of the placebo EA and diet groups. It was suggested that electroacupuncture may be an effective therapy for obesity including the psychological signs and symptoms in women.

Keywords acupuncture, anxiety, depression, obesity, obsession

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INTRODUCTION

Obesity is one of the major health problems in industrialized countries (Leonhardt et al., 1999). Increasing evidence suggests that obesity is not a simple problem of will power or self-control but a complex disorder involving appetite regulation and energy metabolism. Although its etiology is not firmly established; genetic, metabolic, biochemical, cultural, and psychosocial factors may contribute to obesity (Lyznicki et al., 2001). Chronic diseases such as coronary heart disease, hypertension, atherosclerosis, hyperlipidemia, type II diabetes, gallbladder disease, and stroke are frequently observed in obese people (Leonhardt et al., 1999; De Fronzo & Ferrannini, 1991). Moreover, serious psychological and social problems can be seen in obese people.

Acupuncture has been used to treat a variety of diseases and symptoms. Acupuncture is one of the well-known traditional Chinese medical methods. It is increasingly used in Western medicine to treat a range of clinical conditions and particularly in the control of pain. Acupuncture has long been associated with a homeostatic (yin/yang), regulatory, or calming effect (Ullet et al., 1998). Acupuncture application was reported to affect the nervous system (Takeshige et al., 1992; Pan et al., 1996), metabolism (Chang et al., 1999), immune system (Yu et al., 1997, 1998), and gastrointestinal system (Jin et al., 1996). It has been reported that acupuncture application in obesity treatment may provide weight loss by decreasing appetite (Richards & Marley, 1998), regulating intestinal motility (Maciocia, 1989a) and metabolism (Huang et al., 1996; Ernst, 1997; Cabioglu & Ergene, 2005).

Electroacupuncture is frequently used in patients having mental problems. A survey of EA indicates that depression, anxiety, and insomnia are some of the most frequent reasons cited for the use of EA. This may be explained by an increase in blood opioid neuropeptide (Pan et al., 1996) and encephalin (Zhou et al., 1995) concentrations. The neurotransmitter substances such as serotonin and dopamine (Li et al., 1982) may also be involved in the mechanisms of acupuncture.

In the light of the aforementioned studies, this article investigated the effects of electroacupuncture, placebo electroacupuncture, and diet restriction on body weight and intensity of psychological symptoms in obese individuals.

MATERIALS AND METHODS

Participants

The study included women aged between 35 and 50 years and with a body mass index between 30 and 40 kg/m^2. One hundred and sixty-five volunteer

Table 1. The mean age, height, body weight, and body mass index with their standard deviations in the placebo acupuncture, electroacupuncture, and diet groups

Characteristics	PEA group ($n = 30$)	EA group ($n = 105$)	Diet group ($n = 30$)	F	p
Age	36.6 ± 8.2	35.7 ± 6.6	38.4 ± 4.2	1.91	0.51
Height (cm)	1.61 ± 0.06	1.59 ± 0.06	1.60 ± 0.05	1.61	0.20
Body weight (kg)	84.1 ± 2.3	83.4 ± 2.7	84.2 ± 2.3	1.69	0.18
Body Mass Index	32.6 ± 2.8	33.2 ± 2.6	33.7 ± 2.1	1.32	0.26

The values are given with mean $\pm$ SD.

PEA: Placebo electroacupuncture; EA: electroacupuncture.

women were studied in three groups: (i) Placebo Electroacupuncture ($n = 30$; mean age $= 36.6 \pm 8.2$, and mean body mass index $\{\text{BMI}\} = 32.6 \pm 2.8$); (ii) Electroacupuncture (EA) ($n = 105$; mean age $= 35.7 \pm 6.6$, and BMI $= 33.2 \pm 2.6$) and (iii) Diet restriction group ($n = 30$; mean age $= 38.4 \pm 4.2$, and BMI $= 33.7 \pm 2.1$). Test subjects had no history of a major medical or psychiatric illnesses and with no prior experience with acupuncture. To avoid potential confounding variables, subjects who were taking anxiolytic herbs or psychotropic medications were not recruited in the study. No statistically significant differences were found in the mean values of age, height, body weight, body mass index, and pretest of psychological symptoms between these three groups ($p > .05$) (see Table 1).

The Determination of Acupuncture Points

Acupuncture points were determined with an electronic detector that gives a special light when it detects the point. "Personal cun" was used as a measure unit that is used in traditional Chinese medicine.

Selected Ear and Body Acupuncture Points

The Hungry, Shen Men, and Stomach ear points and the Hegu (LI 4), Quchi (LI 11), Zusanli (St 36), Neiting (St 44), and Taichong (Liv 3) body points were selected for the obesity treatment.

The Hungry ear point is placed at the junction of the lines drawn horizontally from the apex tragus and vertically from the intertragic notch. The Shen Men point is placed at one third of the lateral side of the upper edge of trianguler fossa and Stomach point is placed at the end of the helix crus.

The stimulation of Hungry point creates an increase of fullness feeling and suppression of hunger feeling (Asomoto & Takeshige, 1992). The stimulation of Shen Men point regulates cerebral cortex functions and it has a sedative effect (Wang & Kain, 2001). The stimulation of Stomach point regulates gastric functions (Li et al., 1992).

1. The LI 4 point of the body point is located at the dorsal face of hand between first and second metacarpal bones and in the middle of the radial side of the second metacarpal bone.
2. The LI 11 point is located between the Lu 5 (Chise) and the lateral epicondilus of the humerus at the end of transvers cubital line when the elbow is in flexion position. This point is the most lateral point of the elbow transversal curve when the arm is in maximum flexion position.
3. The St 36 point is 3 cun below the patella lower edge and between the tibialis anterior muscle and flexor digitorium communis muscle.
4. The St 44 point is between the second and third phalanges on the foot and at the lateral and distal side of the second metatorsodigital joint.
5. The Liv 3 point is on the dorsum of the foot, in the depression distal to the junction of the first and second metatarsal bones.

Electroacupuncture Application

Electroacupuncture was applied for 30 min from 9.00 to 9.30 a.m. Body and ear EA were performed three times a week. After EA application, permanent ear needles were placed on the Hungry points. The body acupuncture needles were 5 cm long and the ear acupuncture needles were 3.5 cm long, with a .22 mm diameter. Electroacupuncture application was performed by using a "Biotron 1000" instrument (ANDI Electromedical, Holbaek, Denmark) that conveyed an electrical stimulus for .05 ms at 2 Hz frequency and 3 V in square wave form, which has positive and negative alternanses. In this study, electrodes were connected to the Hungry and Stomach points on both ears and on LI 4 and LI 11 with St 36 and St 44 on the body symmetrically in pairs. Acupuncture alone was applied on the Liv 3 points.

Diet Program

A 1450 kcal diet was prepared for test subjects in the placebo EA, EA, and diet restriction groups. This amount was chosen in order to give a diet over their basal metabolism. Subjects continued their daily routine activities as before.

Diet program was explained to the patients prior to the study and their full consent was taken and then calorie intake was continuously checked everyday for placebo EA and EA groups during the study procedure.

Placebo Electroacupuncture

Thirty test subjects had placebo EA applications as described later. In these test subjects, the acupuncture needles were inserted into 3 points on the ear that were unrelated to weight loss and inserted superficially into selected body points that were not acupuncture points, but near the body acupuncture points that were used for the EA group.

Weight and Height of the Participants

Weight of the subjects was measured with standard scales (sensitivity, ± 0.5 kg), before breakfast. Height of the subjects was measured with a steel rule (sensitivity, ± 0.5 cm). The body mass indexes (BMI) of the subjects were calculated by dividing the weights (kg) to the square of the corresponding heights (m^2).

Measure of Psychological Symptom Intensity

In order to measure psychological symptoms intensity before and after treatment, STAI FORM TX-I and SCL-90-R (Symptom Chick List-90-Revised) tests were applied to placebo electroacupuncture, electroacupuncture, and diet restriction groups.

Statistical Analysis

The statistical analyses were performed using SPSS for Windows (V. 12). One-way variation analysis and the Tukey HSD test were used in the statistical analyses. p value less than .05 was considered to be statistically significant.

RESULTS

Changes in Weight Loss in EA, Diet, and Placebo EA Groups

A 4.8% reduction in weight was observed in the EA group, whereas 2.5% and 2.7% reductions in weight were observed in the diet restriction and placebo EA groups, respectively, following 20 days of therapy (see Table 2). The weight

Table 2. The mean body weights with their standard deviations in the placebo electroacupuncture, electroacupuncture, and diet groups

	PEA	EA group	Diet group	F	p
Body weight (kg) 1st day	84.1 ± 2.3	83.4 ± 2.7	84.2 ± 2.3	1.69	NS
Body weight (kg) 20th day	81.9 ± 2.3	79.4 ± 2.5*	82.1 ± 2.3	21.32***	0.00

^{ns}not sign; $^{*}p < .005$; $^{**}p < .01$; $^{***}p < .001$

The values are given with mean ± SD.

PEA: Placebo electroacupuncture; EA: electroacupuncture.

reduction in EA group was significantly more than that in both the diet and placebo EA groups, $F = 21.32$, $p < .001$.

Measure of Psychological Symptom Intensity in EA, Diet, and Placebo EA Groups

There were decreases in global severity index, phobias, anger, somatic, anxiety, obsession, paranoid, depression symptoms in the EA groups compared to those in the placebo EA and diet groups (see Tables 3 and 4). No differences were observed in positive symptom total and psychotic symptoms among the EA, placebo EA, and diet groups, as presented in Tables 3 and 4.

DISCUSSION

This study observed weight loss together with decreases in global severity index, phobias, anger, somatic, anxiety, obsession, paranoid, depression symptoms in obese women using ear and body electroacupuncture. In the diet group, there was a weight loss, but anxiety and depression did not change. These results suggest that EA application is effective in reducing obesity with all the psychological symptoms.

Consistent with these results, Wang and Kain (2001) reported a decrease in anxiety following acupuncture. In the study reported by Wang and Kain (2001), the present authors assessed the effectiveness of acupuncture in reducing anxiety in a volunteer population. Adult volunteers ($n = 55$) were randomized to three treatment groups: (a) Shen Men group-bilateral auricular acupuncture at the "Shen Men" point ($n = 22$); (b) Relaxation group-bilateral auricular acupuncture at a "relaxation" point ($n = 15$); and (c) Sham group-bilateral

Table 3. Measures of psychological symptoms intensity in EA, diet, and placebo EA

	Placebo electroacupuncture		Electroacupuncture		Diet			
	Treatment before	Treatment after	Treatment before	Treatment after	Treatment before	Treatment after	*F*	*p*
Somatic symptoms	1.11 ± 0.64	1.21 ± 0.65	1.07 ± 0.65	0.75 ± 0.59	1.34 ± 0.68	1.43 ± 0.62	15.165***	0.000
Anxiety symptoms	0.83 ± 0.64	0.89 ± 0.61	0.97 ± 0.70	0.66 ± 0.66	1.05 ± 0.76	1.11 ± 0.77	10.639***	0.000
Obsession symptoms	1.33 ± 0.59	1.38 ± 0.57	1.32 ± 0.63	1.00 ± 0.60	1.25 ± 0.72	1.22 ± 0.69	9.971***	0.000
Depression symptoms	1.21 ± 0.52	1.19 ± 0.55	1.16 ± 0.75	0.88 ± 0.70	1.10 ± 0.81	1.16 ± 0.84	7.712***	0.001
Psychotic symptoms	0.64 ± 0.40	0.69 ± 0.44	0.66 ± 0.65	0.49 ± 0.57	0.53 ± 0.47	0.60 ± 0.44	4.379^{ns}	0.065
Paranoid symptoms	0.96 ± 0.62	1.01 ± 0.59	1.08 ± 0.69	0.86 ± 0.74	1.08 ± 0.62	1.12 ± 0.65	3.848*	0.024
Anger	0.95 ± 0.77	0.94 ± 0.77	1.08 ± 0.79	0.79 ± 0.81	0.89 ± 0.72	1.00 ± 0.72	10.958***	0.000
Phobia	0.59 ± 0.53	0.70 ± 0.59	0.59 ± 0.55	0.41 ± 0.50	0.76 ± 0.72	0.75 ± 0.74	5.997**	0.003
Global Severity Index	1.02 ± 0.47	1.19 ± 0.55	1.06 ± 0.57	0.81 ± 0.56	1.05 ± 0.62	1.09 ± 0.62	14.800***	0.000
Positive Symptom Total	44.0 ± 14.9	41.07 ± 0.47	33.4 ± 22.6	41.2 ± 20.5	40.8 ± 20.4	39.6 ± 19.7	0.021^{ns}	0.979

^{ns}not sign; *$p < .005$; **$p < .01$; ***$p < .001$.

The values are given with mean ± SD.

PEA: Placebo electroacupuncture; EA: electroacupuncture.

Table 4. Measures of psychological symptoms intensity compared to in EA, diet, and placebo EA

	Placebo electroacupuncture Mean of difference	Electroacupuncture Mean of difference	Diet Mean of difference	*F*	*p*
Somatic symptoms	−0.0955	0.3206[1]	−0.0813	15.165***	0.000
Anxiety symptoms	−0.0550	0.3106[1]	−0.0579	10.639***	0.000
Obsession symptoms	−0.0500	0.3294[1]	0.0263	9.971***	0.000
Depression symptoms	0.0208	0.2870[1]	−0.0570	7.712***	0.001
Psychotic symptoms	−0.0500	0.1576[ns]	−0.0684	4.379[ns]	0.065
Paranoid symptoms	−0.0500	0.2006[2]	−0.0351	3.848*	0.024
Anger	−0.0083	0.2804[1]	−0.1140	10.958***	0.000
Phobia	−0.1143	0.1898[2]	0.0150	5.997**	0.003
Global Severity Index	−0.0447	0.2665[1]	−0.0319	14.800***	0.000
Positive Symptom Total	−2.9300	7.8000[ns]	−1.2000	0.021[ns]	0.979

[ns]not sign; *$p < .005$; **$p < .01$; ***$p < .001$.

[1]The statistical difference of the EA compared to diet and placebo EA groups.

[2]The statistical difference of the EA compared to placebo EA groups.

[ns] not sign.

auricular acupuncture at a "sham" point ($n = 18$). Press-acupuncture needles were inserted at the respective auricular areas for 48 h. The state of anxiety was assessed at 30 min, 24 h, and 48 h after insertion. In this study, it was demonstrated that patients in the Relaxation group were significantly less anxious at 30 min and 24 h as compared with patients in both the Shen Men group and the Sham group, and less anxious at 48 h as compared with patients in Shen Men group. They used one point on ears symmetrically in pairs. The authors applied EA to the Hungry, Shen Men, and Stomach points on both ears and LI 4, LI 11, St 36, St 44, and Liv 3 on the body. After this application, permanent needles were inserted to Shen Men and Hungry points. A simultaneous reduction in anxiety and body weight was observed after EA application with 2 Hz on both ears and body points every other day over 20 days. The authors think that these effects may be due to the specific application to body together with ear acupuncture including Shen Men point during a longer period.

Röschke at el. (2000) investigated the efficacy of acupuncture together with drug treatment in major depression. However, these authors did not find any difference between the placebo and verum acupuncture. The present study observed a decrease in depression of obese subjects without adding antidepressant drug.

Concerning the mechanisms of electroacupuncture in obesity with psychiatric signs and symptoms, it was reported that acupuncture in obese people increased excitability of the satiety center in the ventromedial nuclei of the hypothalamus (Shiraishi et al., 1995; Zhao et al., 2000). Stimulation of the auricular branch of the vagal nerve and increasing the tonus of the smooth muscle of the stomach were also observed with acupuncture application due to suppression of appetite (Richards & Marley, 1998). It is known that the level of serotonin increased by electroacupuncture application, in the central nervous system and plasma, may enhance the intestinal motility. Stimulation of the LI 4, LI 11 points has a regulatory effect on intestinal motility (Maciocia, 1989a), whereas stimulation of St 36 and St 44 points increases the excitability of satiety center in the ventromedial nucleus of the hypothalamus (Zhao et al., 2000). In traditional Chinese medicine, the St 36 body acupuncture point has been used for the module of intestinal motility (Li et al., 1992). The present study used the Hungry, Shen Men, and Stomach ear points and the LI 4, LI 11, St 36, St 44 body points for the obesity treatment.

Studies in obese patients show that obesity may result from psychogenic factors. Obesity is usually caused by an abnormality of the feeding regulatory mechanism. It is known that people often gain weight during and after stressful situations. It seems that eating is often a mean of relief. In the present study, in

addition to noticing weight loss in obese subjects, there was also a reduction in all psychological symptoms after EA application with diet restriction. Apart from loss of weight in obese subjects, this proves the efficiency of EA therapy in psychological symptoms. This interesting result was not reported by previous investigators. As mentioned earlier, electroacupuncture may increase the level of beta endorphin, encephalin, and serotonin in the central nervous system and blood plasma (Ullet et al., 1998; Han et al., 1999). Accordingly, acupuncture may be used successfully in the treatment of anxiety accompanied by depression.

Stimulation of the Shen Men point has a sedative effect (Wang & Kain, 2001). Stimulation of Liv 3 body point also causes sedation (Maciocia, 1989b). Measurements of serotonin (5HT) content and its metabolite 5-hydroxyindoleacetic acid (5HIAA) in brain and spinal cord of rats, following stimulation of acupuncture point St 36, revealed significant increases in 5HT synthesis and utilization. The authors also applied acupuncture to the Shen Men auricular point and St 36 and Liv 3 body points and found a decrease in appetite probably due to psychogenic factors.

Serotonin has been implicated in the control of eating behavior, body weight, and emotion. It is known that serotonin gives happiness, helps a person to feel good, controls the sexual motivation, and has a role in obtaining the psychomotor balance. It is presumed that the norepinephrine and serotonin systems normally provide drive to the limbic system to increase a person's sense of well-being. In support of this concept is the fact that the pleasure and reward centers of the hypothalamus and surrounding areas receive large numbers of nerve endings from the noradrenergic and serotoninergic systems. Therefore, acupuncture is used in the treatment of psychological illnesses such as depression (Ullet et al., 1998), general anxiety disorder (Ullet et al., 1998), panic attack, and obsessive convulsive disorder.

In summary, the results of the present work suggest that electroacupuncture can be an effective therapy for obesity with accompanying symptoms such as depression, anxiety, and obsession.

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